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Pharmacological characterisation of a P2X receptor cloned from the central nervous system of *Lymnaea stagnalis*

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Background
The CNS of the model organism *Lymnaea stagnalis* is relatively simple consisting of ~20,000 large identifiable neurons. This, together with the fact that the circuitry underlying complex behaviours such as feeding and respiration are well characterized make *Lymnaea* an attractive model to investigate the role of P2X receptors in CNS function.
Methods
RT-PCR with degenerate oligonucleotides was used to identify a P2X receptor fragment expressed in the *Lymnaea* CNS. The full length sequence was obtained by RACE-PCR and the cloned receptor was expressed in *Xenopus* oocytes to facilitate electrophysiological characterisation.
Results
ATP evokes inward currents at *Lym*P2X with slow desensitisation and an EC_{50} of 6.2 microM. BzATP is a partial agonist with a maximum response ~70% that of ATP and an EC_{50} of 2.4 microM whereas alpha, beta-methylene ATP is a very weak agonist and ADP and UTP produce no response. Protons inhibit *Lym*P2X with currents reduced by 55% at pH 6.5 compared to pH 7.5 with no change in EC_{50}. Both PPADS and suramin are antagonists (IC_{50} 9.1 and 27.4 microM respectively). The divalent cations Cu^{2+} and Zn^{2+} have biphasic effects potentiating currents at concentrations up to 100 microM and inhibiting currents at 1mM. *Lym*P2X is insensitive to ivermectin.
Conclusion
This work has increased our emerging phylogenetic knowledge of P2 receptors by adding molluscs to the list of organisms that possess functional P2X receptors. Knowledge of the pharmacological properties of *Lym*P2X allows us now to probe the function of this receptor *in vivo* in the *Lymnaea* CNS.